FEATURES

- Slew rate: 0.93V/μs
- Bandwidth:1.6MHz
- Input/Output full swing
- Low supply current:300μA
- Offset Voltage:0.8mV (Typical)
- Supply Voltage:2.1V to 6.0V
- Operation Temperature Range: -40°C to 125°C
- Micro Size Packages: SOIC and TSSOP

APPLICATIONS

- Transducers
- Temperature Measurement
- Electronic Scales
- Medical instrumentation
- Handheld Test Equipment
- Battery equipment
- Consumer electronics

GENERAL DESCRIPTION

The MT060X series are single, dual, and quad rail-to-rail CMOS operational amplifiers. These amplifiers have the characteristics of input/output full swing, low offset, low power and stable high frequency response. They achieve very good AC performance with 1.6MHz bandwidth, 0.93V/μs slew rate and low distortion while drawing only 83μA of quiescent current per amplifier. MT060X has wide temperature range from -40°C to +125°C.

Single or dual supplies as low as 2.1V(±1.05V) and up to 6.0V(±3.0V) can be used.

The MT0604 is available in the 14-Pin SOIC and TSSOP packages.

SIMPLIFIED SCHEMATIC

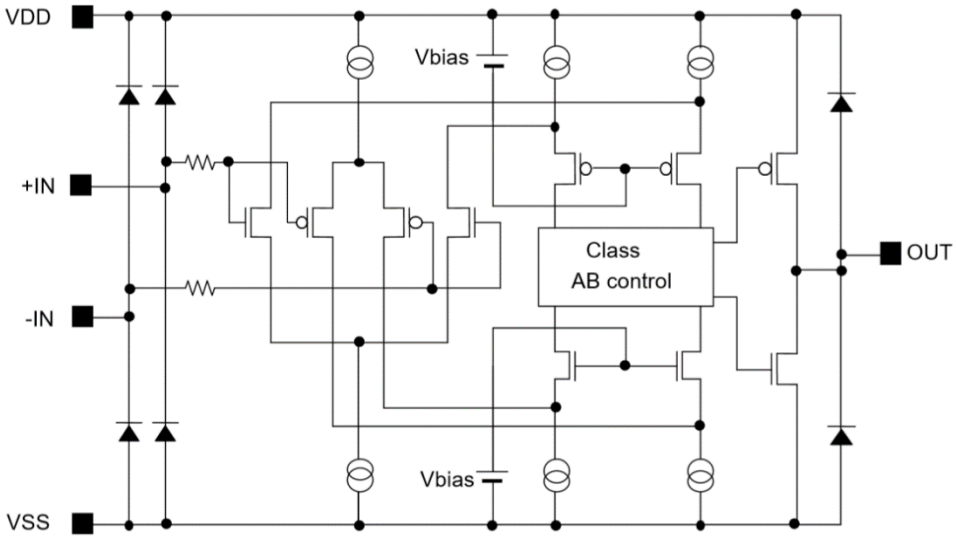
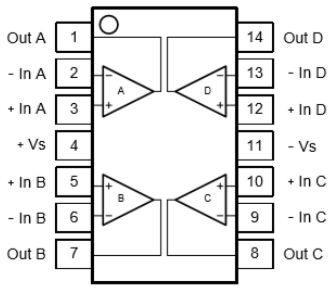


Figure 1. Simplified schematic

ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage.....+2.1V to +6.0V
Input Offset Voltage.....0.8mV(typical)
Input Offset Current.....1.9pA(typical)
Maximum Operating Junction Temperature.....150°C
Operating Temperature Range.....-40°C to 125°C
Storage Temperature .....-65°C to 150°C

PACKAGE/ORDER INFORMATION

TOP VIEW	Order Part Number	Package	Top Marking
	MT0604	14-Pin SOIC 14-Pin TSSOP	MT0604CJ MT0604CG

DEVICE INFORMATION

Order Part Number	Top Marking	Package
MT0604	MT0604CJ	SOIC-14
	MT0604CG	TSSOP-14

PIN DESCRIPTION

Pin Name	Pin Number	Description
OUTA	-	Output of channel A
-INA	-	Inverting input of channel A
+INA	-	Noninverting input of channel A
-VS	-	Positive (highest) power supply
+INB	-	Noninverting input of channel B
-INB	-	Inverting input of channel B
OUTB	-	Output of channel B
OUTC	-	Output of channel C

-INC	-	Inverting input of channel C
+INC	-	Noninverting input of channel C
+VS	-	Negative(lowest) power supply
+IND	-	Noninverting input of channel D
-IND	-	Inverting input of channel D
OUTD	-	Output of channel D

ELECTRICAL CHARACTERISTICS (Note 3)

(At T_A = 25°C, +VS=+2.5V, -VS=-2.5V, R_L =2KΩ, C_L =100pF, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	V_S=5.0V	-3	0.8	3	mV
Input Offset Voltage Drift	TA = -40°C to 125°C		2		μV/°C
Input Bias Current	T_A = 25°C		1.7		pA
Input Offset Current			1.9		pA
Power Supply Rejection Ratio		80	91		dB
Common-mode Rejection Ratio		70	95		dB
Open Loop Voltage Gain	R_L =2KΩ, C_L =100pF	85	119		dB
Gain-bandwidth product	R_L =2KΩ, C_L =100pF		1.6		MHz
Slew Rate	G=+1, R_L =1KΩ, C_L =56pF		0.93		V/μs
Input Voltage Noise	f = 0.1Hz to 10Hz		8		μV_{PP}
Input Voltage Noise Density	f = 1kHz		27		nV/ √ Hz
Supply Current (per amplifier)			300		μA
Operating Temperature Range		-40		125	°C
Storage Temperature Range		-65		150	°C

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.
Note 2: T_J is calculated from the ambient temperature T_A and power dissipation P_D according to the following formula: $T_J = T_A + (P_D)$ x (170°C/W).

Note 3: 100% production test at +25°C. Specifications over the temperature range are guaranteed by design and characterization.

TYPICAL PERFORMANCE CHARACTERISTICS

(At T_A = 25°C, +VS=+2.5V, -VS=-2.5V, R_L =2KΩ, C_L =100pF, unless otherwise noted.)

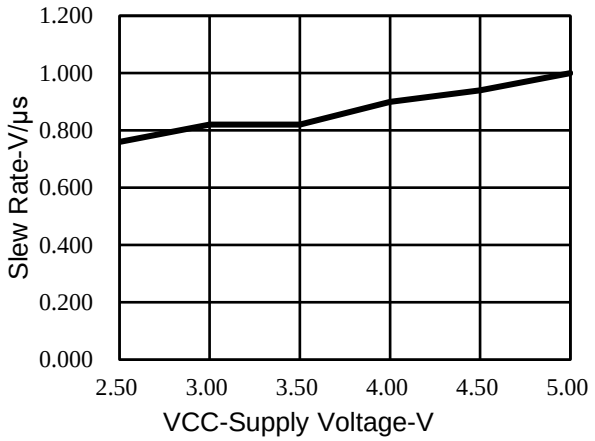


Figure 2. Slew Rate vs Supply Voltage

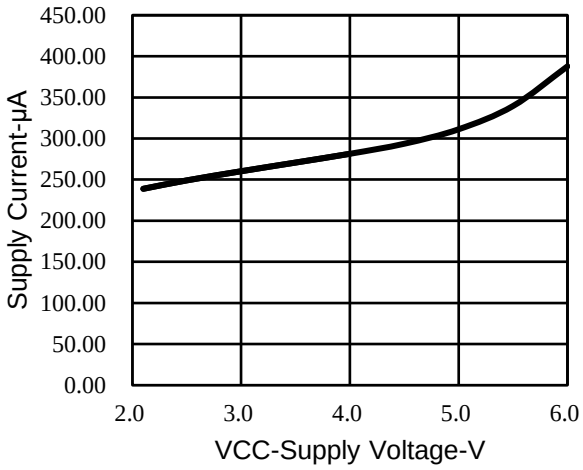


Figure 3. Supply Current vs Supply Voltage

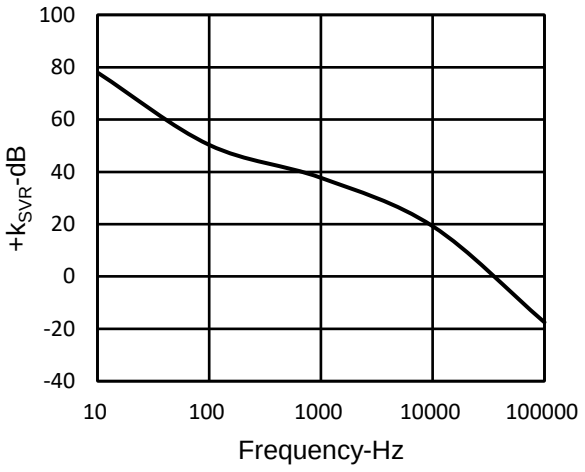


Figure 4. $+k_{SVR}$ vs Frequency

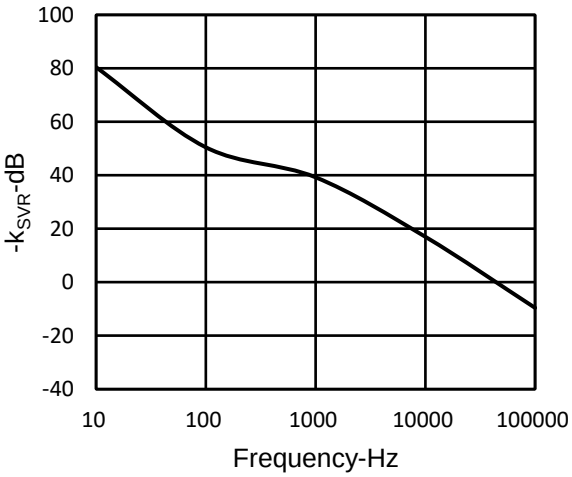


Figure 5. $-k_{SVR}$ vs Frequency

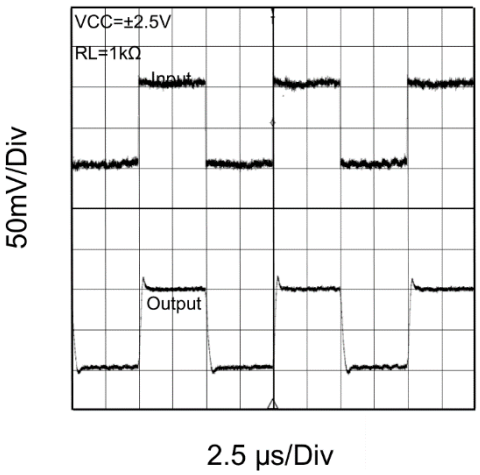


Figure 6. Noninverting Small-Signal Pulse Response

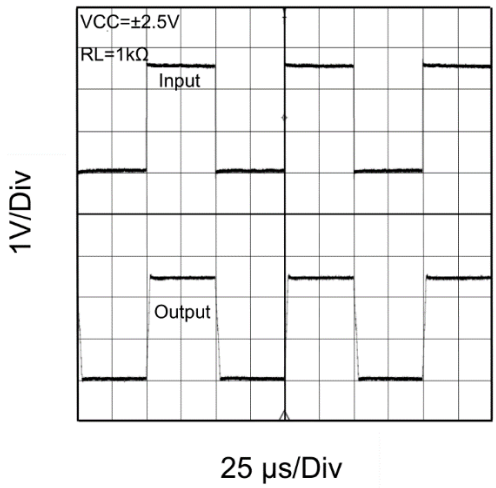


Figure 7. Noninverting Large-Signal Pulse Response

TYPICAL PERFORMANCE CHARACTERISTICS

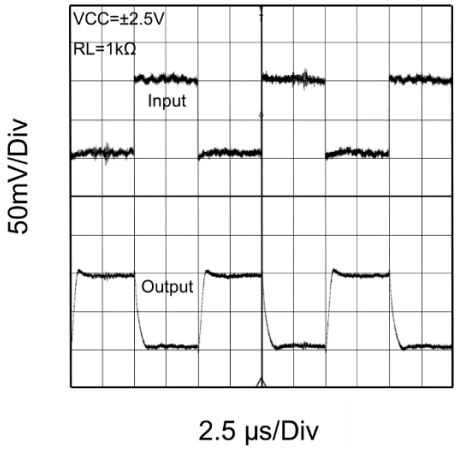


Figure 8. Inverting Small-Signal Pulse Response

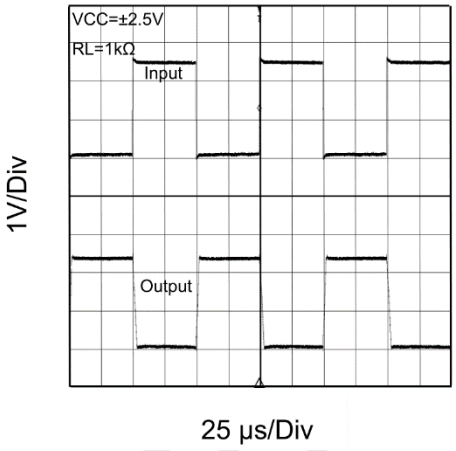


Figure 9. Inverting Large-Signal Pulse Response

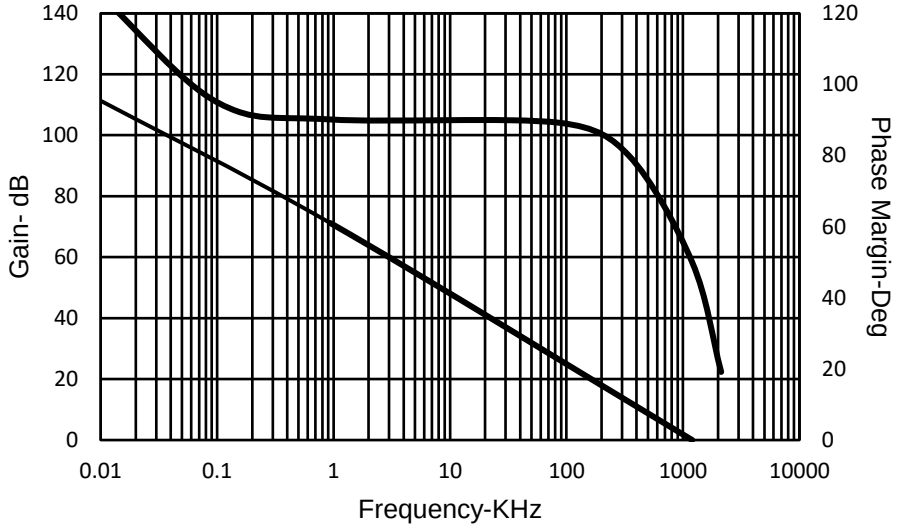


Figure 10. Open-Loop Gain and Phase

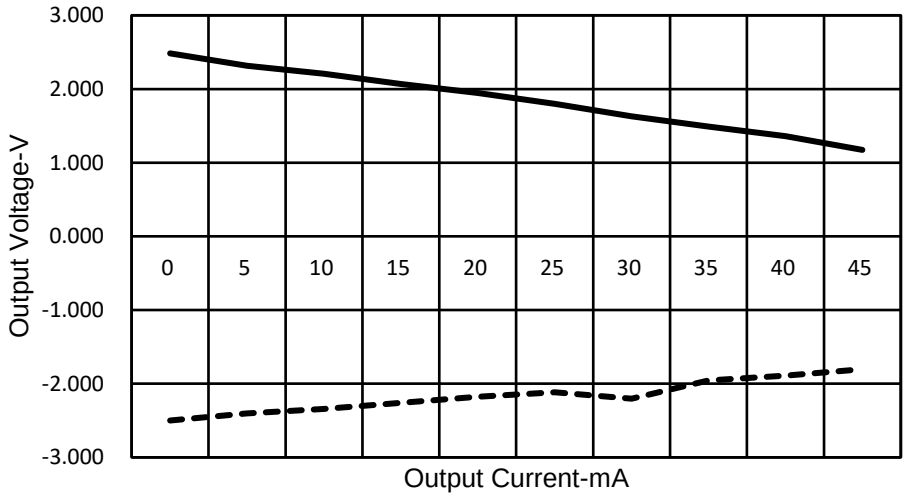


Figure 11. Output Voltage vs Output Current

APPLICATIONS INFORMATION

MT060X are low supply voltage CMOS operational Amplifiers. This amplifier has the characteristics of Input/Output full swing, high slew rate, low supply current and high speed operation. Input bias current is very low at 1pA (Typ). MT060X has wide temperature range from -40°C to +85°C. Single or dual supplies as low as 2.1V(±1.05V) and up to 6.0V(±3.0V) can be used.

Voltage follower

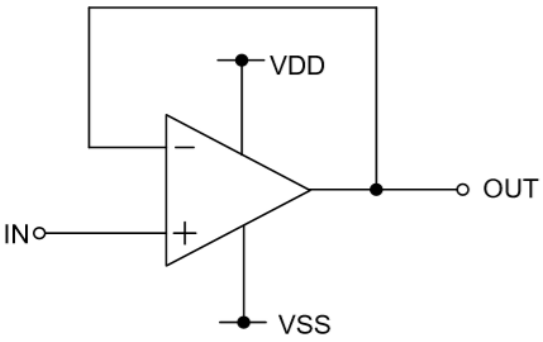


Figure 12. Voltage follower

Voltage gain is 0dB. Using this circuit, the output voltage (OUT) is configured to be equal to the input voltage (IN). This circuit also stabilizes the output voltage (OUT) due to high input impedance and low output impedance. Computation for output voltage (OUT) is shown below. OUT=IN.

Inverting amplifier

For inverting amplifier, input voltage (IN) is amplified by a voltage gain and depends on the ratio of R1 and R2. The out-of-phase output voltage is shown in the next expression

$$OUT=-(R2/R1)\cdot IN$$

This circuit has input impedance equal to R1.

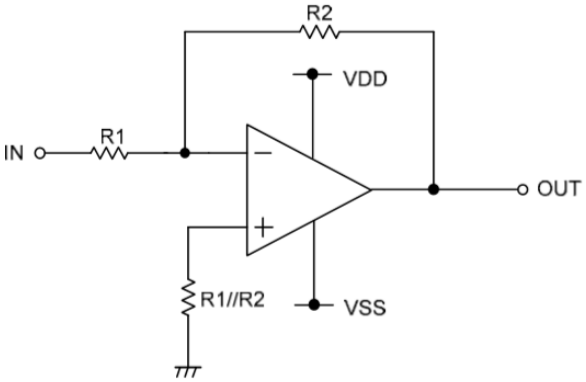


Figure 13. Inverting amplifier circuit

Non-inverting amplifier

For non-inverting amplifier, input voltage (IN) is amplified by a voltage gain, which depends on the ratio of R1 and R2. The output voltage (OUT) is in-phase with the input voltage (IN) and is shown in the next expression.

$$OUT=(1+R2/R1)\cdot IN$$

Effectively, this circuit has high input impedance since its input side is the same as that of the operational amplifier.

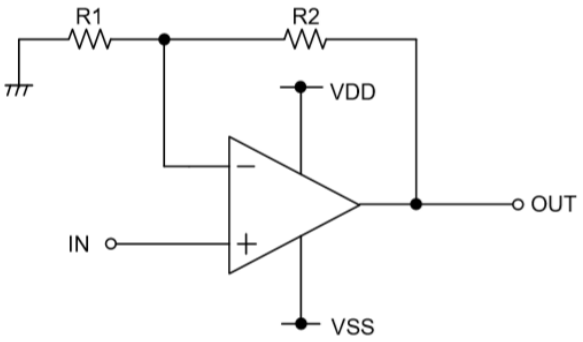
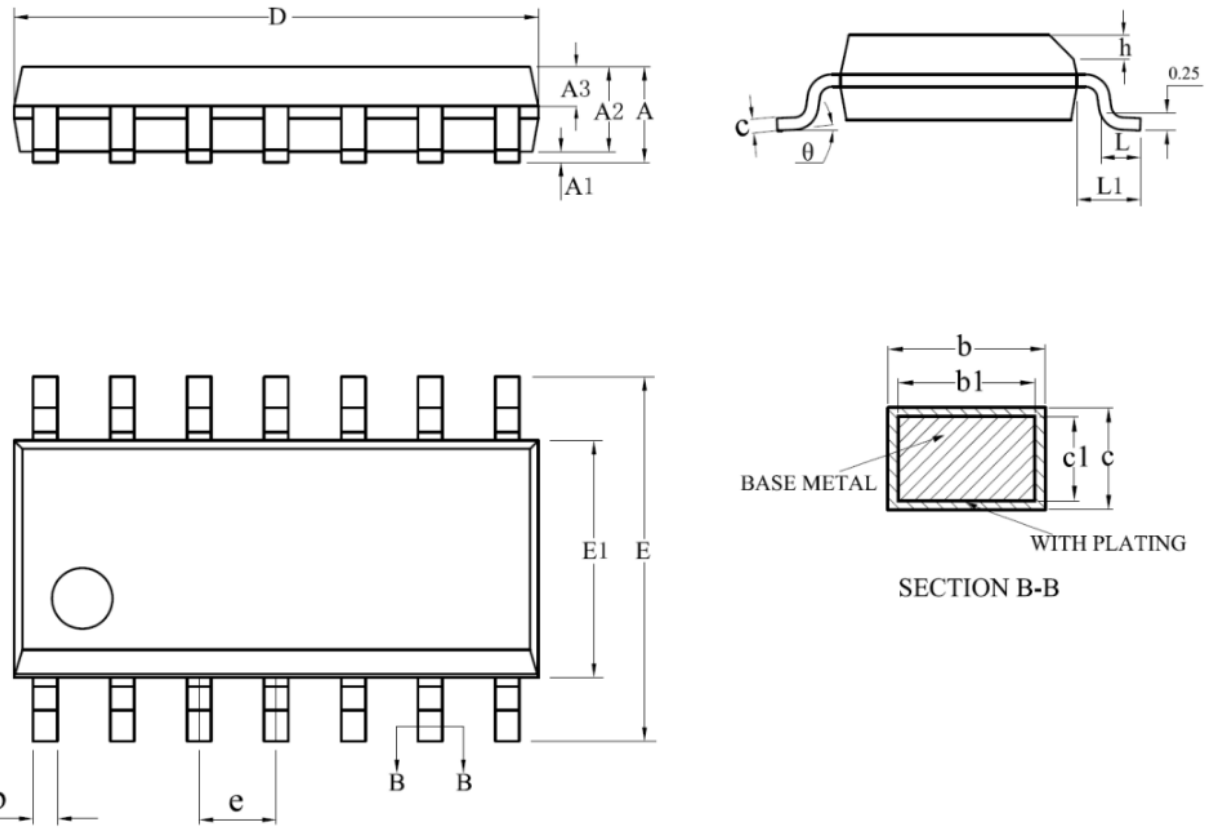


Figure 14. Non-inverting amplifier circuit

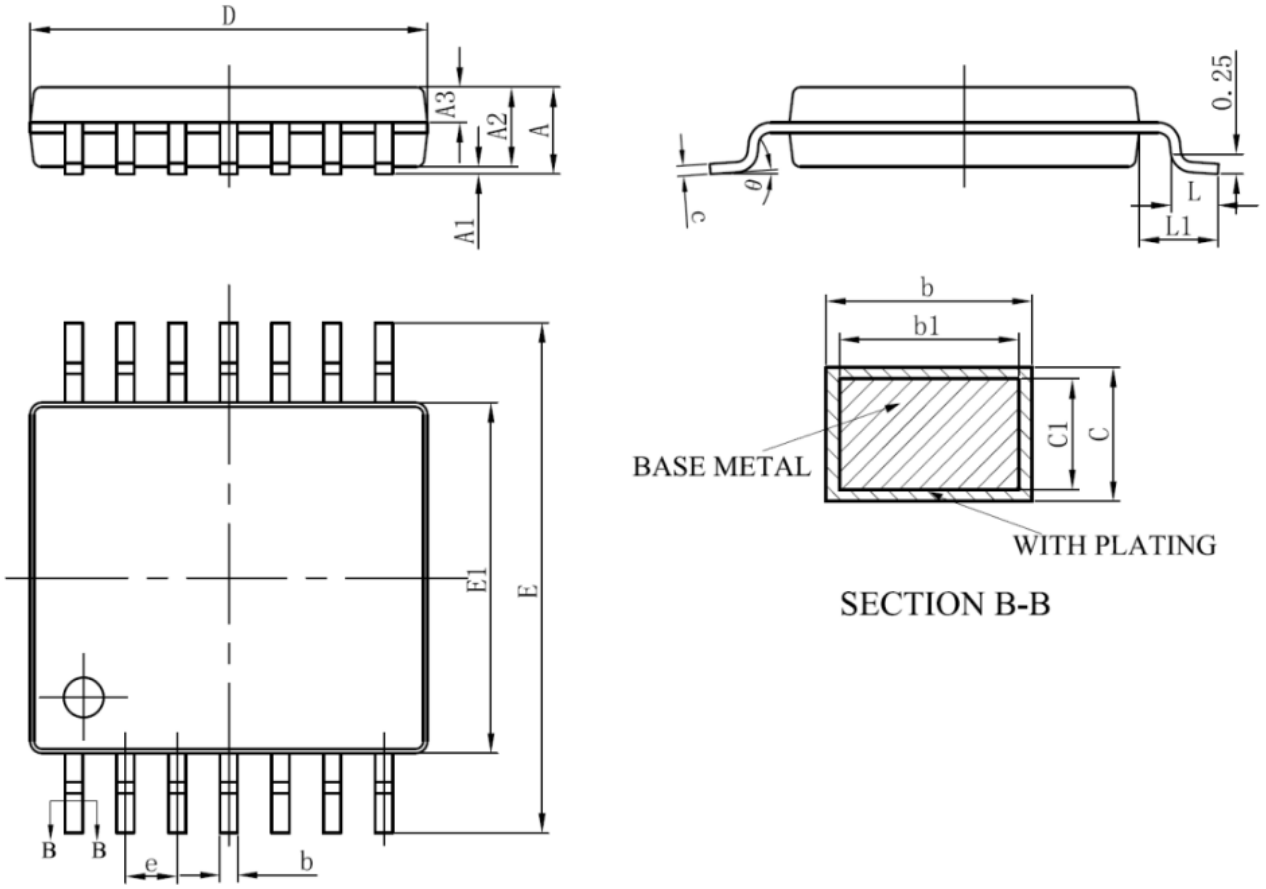
PACKAGE DESCRIPTION

SOIC-14



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	-	-	1.75
A1	0.05	-	0.23
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	-	0.47
b1	0.38	0.41	0.44
c	0.20	-	0.24
c1	0.19	0.20	0.21
D	8.55	8.65	8.75
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	-	0.50
L	0.50	-	0.80
L1	1.05REF		
θ	0	-	8°

TSSOP-14



SYMBOL	millimeter		
	min	nom	max
A	-	-	1.20
A1	0.05	-	0.15
A2	0.90	1.00	1.05
A3	0.39	0.44	0.49
b	0.20	-	0.28
b1	0.19	0.22	0.25
c	0.13	-	0.17
c1	0.12	0.13	0.14
D	4.90	5.00	5.10
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00REF		
θ	0	-	8°

NOTE:
1.All linear dimensions are in inches (millimeters).
2.This drawing is subject to change without notice.
3.Body length does not include mold flash,protrusions,or gate burrs.mold flash,protrusions,or gate burrs shall not exceed 0.006 (0.15) each side.
4.Body width does not include interlead flash.interlead flash shall not exceed 0.017 (0.43)each side.

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